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ABSTRACT

Energy education units (consisting of a general teacher's guide and nine units containing a wide variety of energy lessons, resources, learning aids, and bibliography) were developed for the Indiana Energy Education Program from existing energy education materials. The units were designed to serve as an entire curriculum, resource document, supplementary materials, or as a laboratory manual of "hands-on" activities which could be infused into existing grades 9-12 curricula. Unit III, focusing on energy related to food production and preparation, consists of an introduction (rationale, unit objectives, and general background information), four lessons, unit resources, bibliography, and teacher evaluation form. Each lesson includes lesson title, objectives, background information, activities, evaluation techniques, and resources. Titles of lessons are: (1) Energy Use and Energy Conservation in the Home (Home Energy Game); (2) Energy Consumption in Food Preparation and Production; (3) Food Preparation and Energy Conservation Techniques; and (4) Oven Use and Energy Consumption. (Author/JN)

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LESSONS from An Energy Curriculum for the Senior High Grades

Unit III — Energy: Food Production and Preparation (Energy Use and Conservation)

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LESSONS FROM AN ENERGY CURRICULUM FOR THE SENIOR HIGH GRADES

UNIT III

ENERGY: FOOD PRODUCTION AND PREPARATION
(Energy Use and Conservation)

Division of Energy Policy
Indiana Department of Commerce
Lt. Governor John M. Mutz, Director

Division of Curriculum
Indiana Department of Public Instruction
Harold H. Negley, Superintendent

January 1982

FOREWORD

Indiana educators have always responded to the demands placed upon them by society to resolve natural and human resource issues and problems. The task of teaching energy concepts and conservation practices to Indiana's youth is a response to energy problems facing our state and nation. It will be accomplished by many high school teachers and students getting involved in energy education.

We feel that students of all ages must be taught an energy conservation ethic. This ethic will enable each student to use Indiana's and America's energy resources more efficiently and with less waste. To help high school teachers accomplish this major goal, we are pleased to introduce a new Senior High School Energy Education Curriculum. This exciting and innovative program contains energy education activities, programs and resources for you and your students.

We encourage you and your students to get involved in the lessons presented here. We hope you will use these materials as a starting point and go far beyond by involving other classroom teachers, students, resource agencies and citizens in your community. A broad educational effort is needed to help prepare students to deal with this growing issue which affects us all.

Harold H. Negley
State Superintendent of
Public Instruction

John M. Mutz
Lieutenant Governor
State of Indiana

ACKNOWLEDGEMENTS

The Energy Education Curriculum Project is coordinated by the Indiana Department of Public Instruction, Division of Curriculum, with the support and assistance of the Indiana Department of Commerce, Division of Energy Policy, Clarence Broadus, Director.

These materials, from the senior high grades segment of the Energy Education Curriculum Project (EECP), were adopted from existing national energy education programs. The materials were selected by the EECP staff with assistance and direction from a Review Panel and the Energy Education Steering Committee.

The materials included in this unit of the senior high segment of the Energy Education Curriculum Project (EECP), were adopted with permission from:

> Energy Management Strategies for Colorado Home Economics Teachers, developed by the Colorado State Board of Community Colleges and Occupational Education, by the Public Service Company of Colorado and by Energy and Man's Environment of Portland, Oregon. (See logos on following page.)

George E. Cannon, Patricia Shutt and Joe E. Wright, Energy Education Consultants, and Carol Hahn Wood, Teacher Associate with the EECP, assumed responsibility for designing this energy education program. They also coordinated the Senior High Review Panel and the Senior High Energy Education Steering Committee.

Members of the Senior High Energy Education Steering Committee are -- John A. Harrold, Director, Division of Curriculum; Darrell Morken, Director of the Division of Traffic Safety; Gary Geswein, Vocational Agriculture Consultant; Jerry Colglazier; Science Consultant, Joyce Konzelman, Home Economics Consultant; Jane Lowrie, Social Studies Consultant; Victor Smith, Research and Evaluation Coordinator, and Gregg Steele, Industrial Arts Consultant,

Michael Hennegan, Residential/Education Coordinator, Division of Energy Policy, also served on the Steering Committee and offered suggestions and comments which helped to improve the materials.

This material was prepared with the support of the U.S. Department of Energy (DOE) Grant No. DE-F645-76CS 60038. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of DOE.

The logos for the developers of "Energy Management Strategies for Colorado Home Economics Teachers" appear below:

UNIT III

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INTRODUCTION
(Rationale)

ENERGY EDUCATION- WHAT IT IS - Past, Present, Future

Energy education is the attempt to resolve the conflict between our present life style and the energy costs in both dollars and resources to produce and maintain that life style.

Energy education is reality education in that it deals with what exists here and now.

But, energy education is also a study of futuristics. The future that all of us must be willing to live in and accept is the one that we are creating right now by our daily decisions. We must examine the beliefs that "growth is good" and "bigger is better" and determine the impact these beliefs will have on our future.

Energy educators interested in the challenge to teach students about local, state, national and global resources, problems and issues should consider the following questions:

1. Can you help prepare your students to make wise and careful decisions about our reminaing non-renewable energy resources?

2. Can you help prepare them to investigate and make wise decisions about research and development efforts for alternate and renewable resources, recycling programs, more efficient transportation systems, better personal consumption habits, and a personal commitment to efficient energy usage?

3. Can you explain to your classes where energy comes from, the basic sources of energy are, how long our non-renewable energy resources will last, and the energy options among which our nation's people must choose if we are to survive?

The three questions above suggest that energy education is a challenge which encompasses all facets of living. Energy education is an opportunity for students to have impact on a long-lived problem, an opportunity to apply traditional content and skills to an important problem situation, and an opportunity for students to participate in personal and social decisions.

WHY STUDY ENERGY?

"One of the best ways to deal with a crisis is to consider it as an opportunity. From this point of view, the energy crisis provides almost endless possibilities for children to learn about themselves." Energy, after all, is what makes all things

go. We need to realize that the energy crisis isn't just the newest fad. By studying the energy crisis, students can see where humanity has been, where it is now, and where it might be going. The energy crisis is another chapter in the story of mankind's continuing effort to reshape the world and the inevitable cost of doing that."[1]

To ensure proper utilization of energy sources, our society must be educated about alternate lifestyles, energy resources, technology, consumer behavior and occupations.

The Indiana Department of Public Instruction, in cooperation with the Department of Commerce, Division of Energy Policy has organized the Energy Education Curriculum Project (EECP) to meet the challenge of educating young people (our future adults) about energy, the energy crisis and the role they can play to help conserve America's economy and resources.

One way the Energy Education Curriculum Project staff has dealt with the task of disseminating energy information and education is through the Indiana Energy Curriculum Units. The units have been organized to help provide educators in many areas with lessons, charts, materials and "hands-on" activities to be used in the classroom.

[1]Quote taken from: The Science Teacher -- September, 1978.
Article: "Teaching the Energy Lesson"
Author: David J. Kuhn

The Curriculum Background Information

The Energy Education Units were adopted from existing national energy education materials. A team of teachers reviewed and evaluated energy documents and programs from across the nation, and only those activities or lessons which proved to be effective in educating students about energy were chosen.

The units are designed to be used as the individual teacher wishes. The energy units could be used as the entire curriculum or as a resource document, supplement or laboratory manual of "hands-on" activities which can be infused into already existing curricula.

The Indiana Energy Education material for grades 9-12 consists of a Teacher Guide, nine units containing a wide variety of energy lessons, resources, learning aids and a bibliography.

Unit III

Unit III entitled "Energy: Food Production and Preparation (Energy Use and Conservation) continues as the third unit of the nine-unit series of the Indiana energy education program for the senior high grades. The unit provides lessons and activities for students and teachers to explore the many aspects of energy and energy consumption.

Unit Objective

The students will demonstrate an increased awareness and understanding of energy resources and conservation by making wise decisions concerning energy use, alternate resources, choices of future homes and occupations.

Background Information

1. Energy use and energy conservation have always been a part of everyday existence. In the past, man explored ways of acquiring energy and keeping it or conserving the energy. This was true as early man settled around the camp fire. Once the fire was made, it was maintained as long as possible for warmth and cooking.

2. Today the same dilemma confronts mankind in his highly technological world. It has been found that through understanding and application of energy facts, man can change daily habits to save money and resources. These conservation and saving activities must continue to ensure a quality style of living and survival for future mankind.

UNIT III

LESSONS A - D

Note: The lessons that follow may be infused into the existing curriculum.

LESSON TITLE: Energy Use and Energy Conservation in the Home
(Home Energy Game)

LESSON OBJECTIVE

The student will identify and select energy conservation practices in the home.

BACKGROUND INFORMATION:

Materials and Equipment: Game board, markers, decks of question cards and "Special" cards, list of questions and answers, rules for games.

Introduction: Have materials out on tables. As an attention-getter, ask the following questions:

How many know what your family electricity bill was last month?
How many know how to read your gas meter?
How many of you saved water in the last couple of days by taking a quick shower instead of a bath?
How many of you either walked to school or car-pooled to school today?
How many of you can list three forms of energy?

Pass out rules of YOU - The Energy Game and discuss.

Rules for Playing:

1. Divide students into groups of four or five. One student in each group should act as monitor with the answer key.
2. Shuffle decks of cards.
3. Each player should select a different marker and place it on the "Start" square.
4. Each player takes his/her turn by drawing the top card on the pile of question cards, reading the question aloud, and then stating the answer. If the player answers the question correctly according to the answer sheet, she/he advances the number of squares indicated on the card. If the player answers incorrectly, she/he remains on the same square.
5. Players landing on a "Special" square will pick a card from the "Special" deck and follow directions given on card.

6. Play continues in a clockwise rotation until someone reaches the "Success" square on the board. The first player to do so is the winner.
7. Questions with more than one possible answer may be accepted by group and/or teacher approval.

ACTIVITIES: Playing the game

EVALUATION

Teacher observation of individual student's progress. Note question areas students did and did not know.

Question Cards:

1. Give the name or symbol for the independent testing agency which tests electrical products for safety.
(Underwriter's Laboratory or UL) 2 points

2. T-F If electric appliances are disconnected before cleaning or repairing , there is no danger of electric shock.
(True) 1 point

3. The amount of power used by small appliances is measured in _____.
(Watts) 2 points

4. T-F You get more light from one 100-watt bulb than from two 50-watt bulbs even though they use the same amount of energy.
(True) 1 point

5. T-F Fluorescent lights are more efficient and more economical than incandescent lights.
(True) 1 point

6. When baking in the oven with aluminum foil, which side should be to the outside? Why?
(Dull side) 2 points (Helps to absorb heat) 2 points
(4 points total)

7. Of the energy-consuming equipment in the average home, which two use the highest percentage of energy.
(Furnace-heating and the water heater)
2 points each (4 points total)

8. List two hints in cooking foods which save energy.
(Cook at lowest suitable heat, use little amount of water, thaw foods completely before cooking, do not overcook, or use tight fitting lid.)
(Other answers possible.) 4 points

9. T-F Hot water aids in optimum use of the garbage disposal.
(False) 1 point

10. One dripping faucet may cause the loss of a possible total of _____ gallons of water per day.
A. 5 gallons B. 25 gallons C. 50 gallons
(C = 50 gallons) 1 point

11. When using the clothes washer to keep energy and water usage to a minimum, match the water level to the _____ size.
(Load) 2 points

12. T-F As a general rule, small appliances use less energy than large ones when preparing a given food.
(True) 1 point

13. List two features of pots and pans which help conserve energy (besides the materials they are made of).
(Tight fitting lid, straight sides and flat bottoms) 4 points

14. Why do surface burner pans save energy when kept shiny and clean?
(Reflects more heat) 3 points

15. Of the following which 3 appliances use the most electricity?
A. Clock, electric blanket, electric skillet
B. Refrigerator-freezer, toothbrush, mixer
C. Vacuum cleaner, can opener, dishwasher)
(Refrigerator-freezer, toothbrush, mixer)
2 points

16. T-F A pop-up toaster uses less energy than a toaster oven.
(False) 1 point

17. Name 2 ways to reduce energy used by the freezer.
(Planning trips to avoid opening door too often, keep freezer as full as possible, defrost often.) (Other answers possible.)
4 points

18. Name one way we can use the clothes washer to save energy. (Full loads, cold water rinses) 2 points

19. List at least two ways to save energy when drying clothes.
(Keep filter clean, dry only until damp, remove clothes immediately, use only for bulky items, use clothes lines) 4 points

20. List an effective way of reducing energy by the dishwasher.
(Open door during heat cycle and let air dry, wash only full loads.) (Other answers possible.)
2 points

21. T-F A dishwasher requires the same amount of energy to wash a 3-place-setting of dishes as it does to wash an 8-place-setting load.
(True) 1 point

22. Choose the best answer. Cooks may reduce heat loss in the oven by avoiding: (a) Turning the light on during cooking. (b) opening the oven door during baking: (c) use of metal pans in the oven.
(b) 2 points

23, Name 2 ways to reduce energy used by the refrigerator.
(Avoid opening door often, avoid packing the refrigerator; if safety is not a factor, cool hot foods before refrigeration.) (Other answers possible.)
4 points

24. Why do self-cleaning ovens use less energy than regular ovens during oven baking?
(More insulation in self-cleaning oven.)
3 points

25. T-F A 5% moisture content left in clothes after drying cycle will reduce wrinkling if they are removed immediately.
(True) 1 point

26. If dried on the permanent press cycle, clothes will wrinkle less if allowed to cool in the dryer before removing. (False) 1 point

27. T-F A non-self-cleaning oven costs less per hour to use than a self-cleaning oven.
(False) 1 point

28. T-F At 1979 prices a gas clothes dryer costs more to operate per load than an electric clothes dryer.
(False) 1 point

29. T-F If preparing two baked potatoes, it takes less energy to use the microwave than a reguiar oven.
(True) 1 point

30. T-F Pre-heating your oven for 15 minutes before baking saves energy. (False) 1 point

31. T-F Microwave cooking is most efficient at the high setting. (True) 1 point

32. List a technique to use to conserve water when preparing dishes for the dishwasher.
(Use rubber spatula-no need to rinse off dishes.) 3 points

33. Explain how keeping drinking water in the refrigerator saves water.
(Eliminates need to run water in faucet to get cold water.) 2 points (Also allow 2 points for answer: It won't save water for those who are willing to drink at tap temperature.)

34. Why does using cold water in the washer save energy?
(Eliminates water heating costs) 2 points

35. T-F Washing a full load of clothes takes less water than two half-loads. (True) 1 point

36. When hand rinsing dishes, list a technique to save water. (Do not leave water running during rinse. Fill sink full of water and dip dishes in.)
2 points

37. List two refrigerator placements which increase its energy use.
(Heat vent, dishwasher, range, windows and sunlight may cause energy loss if next to the refrigerator.) 4 points

38. Give one way to conserve water regarding faucets.
(Shut off faucets completely, put a water-saver on shower head, repair leaky faucets.)
2 points

39. Why should user manuals for equipment be read in order to save energy?
(To get most efficent use of your equipment, prevents possible damage, prevents safety hazards.) (Other answers possible.)
2 points

40. T-F If a glass pan is used for baking a cake, the baking time will be decreased.
(False) 1 point

41. T-F Keeping your freezer defrosted results in less energy use. (True) 1 point

42. T-F Energy efficiency is reduced when overloading electrical circuits. (True) 1 point

43. Name 3 places in your home where warm air may escape during the winter.
(Cracks, doors, windows, fireplaces, walls, foundations, ceilings.) (Other answers possible.)
3 points

44. Name 2 ways to reduce heat loss from the home.
(Stop air leaks, replace furnace filters, add insulation, use storm windows, caulk and weatherstrip windows and doors, other answers possible.) 2 points

45. T-F An automatic defrosting refrigerator uses the same amount of energy as does a manual defrosting refrigerator.
(False it uses more.) 1 point

46. Give three examples of where human energy can substitute for fuel energy.
(Opening can by manual method, washing dishes by hand, avoiding use of electric toothbrush, ride a bike or walk, hanging clothes on lines to dry.) (Other answers possible.) 3 points

47. T-F Keeping the lint filter clean in the clothes dryer has no effect on the energy efficency of that appliance. (False) 1 point

48. Explain why using light colors for walls and ceiling helps to conserve energy.
(Reflects more light and requires less artificial lighting.) 2 points

49. T-F Space heaters are low energy users.
(False) 1 point

50. How do oven timers reduce energy waste? List one way.
(Eliminates opening oven door and/or lifting lids.)
(Other answers possible.)
1 point

51. If preparing a chicken for casseroles, which appliance would be the most energy-efficient to use. Choose best answer. (a) microwave, (b) pressure cooker, (c) simmering on low heat on range.
(pressure cooker) 1 point

52. When is the best time to use the self-cleaning feature on a dirty oven?
(When oven is already hot or at night when fuel use is lower.) 2 points

"SPECIAL" CARDS

1. Advance 2 spaces. Stand up and shout, "Energy Conservation."
2. You have just opened the refrigerator door for the tenth time in preparing a meal. Go back 3 spaces.
3. You used the wrong size of burner for pan size. Go back 2 spaces.
4. You used clothes line instead of clothes dryer. Go ahead 2 spaces.
5. You opened your can manually. Go ahead one space.
6. You left the water running while you peeled the onion. Go back one space.
7. You forgot to turn out the lights when leaving the kitchen. Go back 2 spaces.
8. You forget to turn off the oven after you took your pizza out. Go back 2 spaces.
9. You peeked in the oven at your masterpiece three times and lost oven heat. Go back 2 spaces.
10. You learned to use the pressure cooker to save energy. Move ahead 3 spaces.
11. You remember to set the oven timer to eliminate opening door to check on your souffle. Move ahead 2 spaces.
12. You are remembering to use the microwave for small quantities of food. Go ahead 2 spaces.
13. You planned an oven meal with foods which were baked at the same time. Move ahead 2 spaces.
14. You cleaned the refrigerator coils to save energy. Go ahead 1 space.

RESOURCES

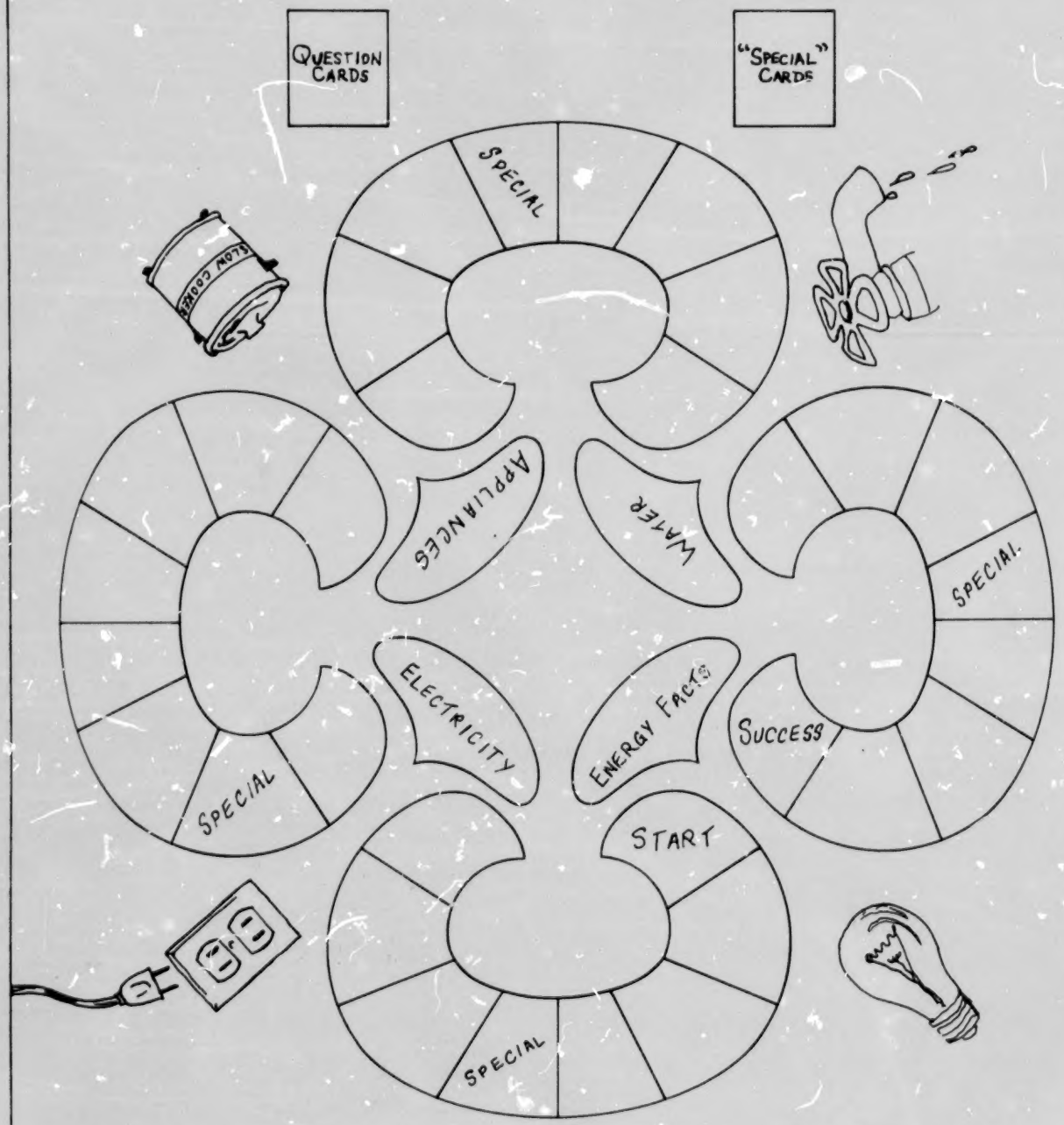
This activity was developed by:

Bonnie Bonewita, Loveland High School

Patricia Rodriquez, Thompson Valley High School

Carilyn K. Norris, Assistant Professor, Vocational Home Economics Education, Colorado State University

unit of instruction:	subject area:	suggested for:
Introduction	Energy	Junior and Senior High School



YOU – The Energy Game

LESSON TITLE: Energy Consumption in Food Production and Preparation.

LESSON OBJECTIVE:

The student will be able to give examples of sources of energy used for food production and processing.

BACKGROUND INFORMATION - See next page

ACTIVITIES Time: 20 minutes

1. Have students bring pictures of appliances used frequently in the kitchen to class.

2. Make a bulletin board or collage about energy usage in the kitchen.

MORE ACTIVITIES

Teacher displays cartoon of kitchen with abundance of electrical appliances and gadgets. A caption comes from the television, "The President announces - "all households must cut back on energy expenditures." A couple thinks, "How could we possibly help?"

Students brainstorm picking out all possible energy uses in the picture. Additional items might include:

1. calculating the amount of energy used by each appliance.

2. group appliances by similar jobs accomplished and compare the energy used by each.

See dittos #1 and 2.

SUGGESTED MATERIALS

Cartoon and overhead or opaque projector.
Transparency or handout master.

DEVELOPED BY:

Jan Scrogan
Lois Stone

RESOURCES:

U.S. Department of Energy, Section 6-FOOD

BACKGROUND INFORMATION

The high productivity of the American food industry depends on large quantities of energy to produce, process, transport, store and prepare a large variety of foods. As a result, advanced agricultural systems are running up an energy deficit. As the geographic distance from producer to consumer lengthens, the degree of processing increases and energy is substituted for labor and natural soil fertility, the energy deficit increases.

In 1910, the energy content of food produced in the U.S. was slightly greater than the energy used to grow, process and transport the food. In 1970, however, nine times as much energy was consumed by the food system as was contained in the food produced. In other words, by the time the food reaches the consumer's plate, the total energy expended is many times that contained in the food being eaten. It is the processing, transportation, and distribution of the food that absorbs most of the energy. Therefore, it is wise to select food items carefully, as well as to store and prepare them efficiently.

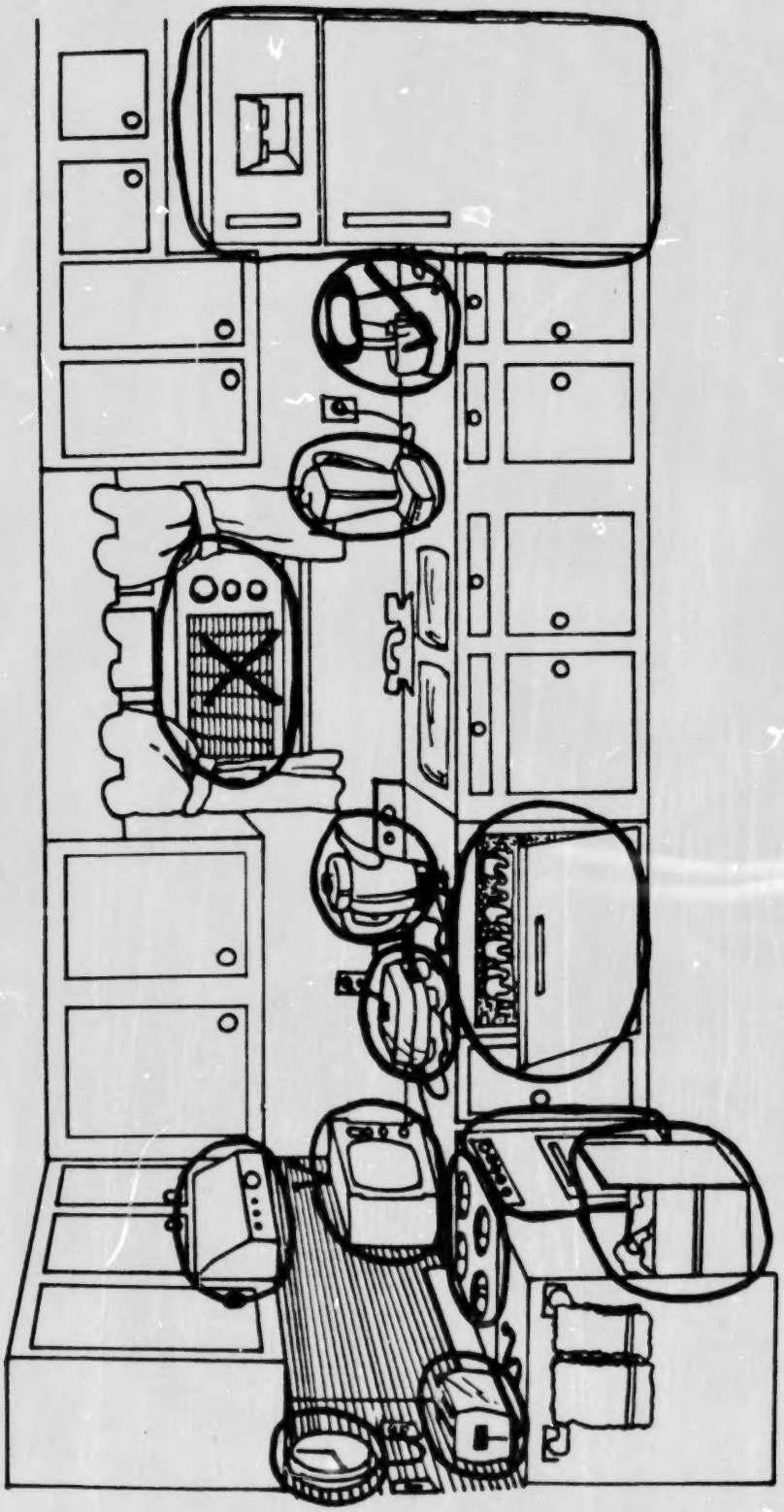
The home preparation of food accounts for almost four percent of the total U.S. energy consumption. The major in-home energy consumption for food occurs in storage (refrigeration and freezing) and preparation (ranges, ovens and small appliances).

The storage and preparation of food includes energy use by appliances both directly and indirectly. There is a direct

use of energy for refrigeration, cooking and dishwashing. The indirect use of energy is for hot water, to maintain a comfortable room temperature where appliances are operating and for manufacturing the appliances. Appliances and equipment account for 33 percent of the energy consumed in the home. The water heater, refrigerator and range are the top energy users.

Credit to: U.S. Department of Energy, SECTION 6 - FOOD

"THE PRESIDENT ANNOUNCES... HOMEOWNERS MUST CUT BACK ON ENERGY EXPENDITURES..."
HOW COULD WE POSSIBLY HELP?



LESSON TITLE: Food Preparation and Energy Conservation Techniques

LESSON OBJECTIVE:

The student will be able to use and maintain cooking appliances. The student will be able to practice food preparation techniques which foster energy conservation.

BACKGROUND INFORMATION - See Attached

ACTIVITIES

1. Assign each student an appliance. Make 2 identical cards stating or picturing a tip for wise use of that appliance to conserve energy. Divide class into groups of four (4). In each group have one student draw a picture of an energy wasting monster. Play like "Old Maid."

2. Have students construct a wall displaying energy savings for kitchen appliances.

3. Conduct experiments comparing different food preparation techniques.

4. Plan, prepare and compare:

   a. an oven meal
   b. a pressure cooker meal
   c. a small appliance meal

RESOURCES

Cardboard to construct playing cards.
Energy Budget Manager

DEVELOPED BY:

U.S. Department of Energy

BACKGROUND INFORMATION

Energy can be saved by the proper selection, use and maintenance of appliances and judicious food preparation practices.

The major energy consumer for food preparation is the range, which ranks fourth after the heating/cooling system, water heater and refrigerator in home energy consumption. Other appliances used for food preparation (blenders, broilers, toasters, coffeemakers) use very little energy compared to the range. Therefore, the range offers the greatest opportunity to conserve.

The first consideration in energy-efficient food preparation is the selection of a range. Ranges are relatively efficient appliances. Surface units on electric ranges are about 75 percent efficient and approximately 55 percent of all food preparation is done on surface units. Cooking inside the oven is generally a more efficient use of energy; since the heating is intermittent, much heat is retained within the oven walls and there is less convection loss. Due to the necessity for oven ventilation for good baking results, oven efficiency could be increased only minimally. However, self-cleaning ovens, because of their additional insulation, require even less energy to operate then standard ovens. Also, microwave ovens are quite efficient for cooking certain types of foods. Although ranges do not have energy consumption fact tags, they will be labeled in the near future just as air conditioners and refrigerators are. For the time being, the consumer must rely on reputable manufacturers and dealers when selecting cooking appliances.

In addition to efficiency and quality of the unit, the consumer should consider its appropriateness for the family's lifestyle. The use of over-sized units is very inefficient. Microwave ovens, toasters, coffeemakers, and other small appliances should be used when appropriate. There has been some question as to how much energy a microwave oven could save and tests of efficiency are being done now. Consumers Institute has found that microwaves offer the greatest energy savings in cooking small to medium quantities of concentrated foods such as meats, potatoes, desserts, and TV dinners, but their studies indicate some foods actually require more energy in a microwave oven than cooked conventionally. Some of the test results follow:

Food Cooked in Microwave Oven	Energy Consumption
4 Baked Potatoes	60.7% less than ccm*
1 Frozen TV dinner (11½ oz.)	79.3% less than ccm
Casserole (4½ cups)	58.4% less than ccm
Summer Squash (16 oz.)	58.4% less than ccm
Peas and Celery (3½ cups)	46.1% more than ccm
Frozen Broccoli (10 oz.)	30.2% more than ccm

*ccm - conventional cooking method.

Gas range pilot lights have come under recent attack because of their energy consumption (1/3 to 1/2 of the total gas used by the range). However, in addition to providing a starter flame, pilot lights provide the safety shut-off system for the gas supply and a small amount of space heating in winter. Thus the issue isn't as simple as it might seem at first glance. For instance, if the gas were used to generate electricity, about two-thirds of its energy would be lost at the power plant alone. Appliance manufacturers are seeking to reduce the energy waste of pilot lights by using small flames. Also, electric ignition is currently available on at least some models produced by the majority of gas range manufacturers.

The key to the cost of operating cooking appliances is the way in which they are used. The consumer has the opportunity to exert a great deal of control over the energy consumption of the range, cooktop, or oven. First, cooking appliances should be used as they were intended:

HINTS FOR CONSERVATION
(The Range and Oven)

1. Don't use the range for heating the kitchen. This wastes a lot of energy since the range is not an efficient space heater. It is also dangerous!

2. Don't use the oven as a dryer. It is not economical and it can start a fire.

3. When cooking only small quantities, it is usually more economical to use small appliances rather than the range top or large oven. Toasters, waffle irons, skillets, grills, popcorn poppers, fondue pots, bean pots and coffeemakers use less energy for their specialized jobs than does the range. If you have both a small and large oven, use the small one whenever possible.

4. Preheating the oven is often unnecessary and may be a waste of energy. When preheating is required, or when baking time is only a few minutes, avoid preheating for longer than 1 minute. Use a timer as a reminder that the oven is heated. Surface units should not be pre-heated. Put pots and pans on the range top before the heat is turned on to avoid wasting heat.

5. Don't be an oven peeker. Every time the oven door is opened during operation, the oven temperature drops 25 to 50 degrees. A range with an oven door window might be a good investment for the "peek-a-boo" cook.

6. If food must be kept warm for extended periods, store it in an oven set no higher than 140oF to 200oF.) (Caution: Food may become contaminated if kept warm at temperatures below 140oF.) A food warmer built into the range usually requires less energy than the oven or surface unit when used for keeping food heated. Foods, plates and platters can be warmed with the stored heat remaining in an oven after baking with no additional energy use. A ceramic tile warmed while baking can be used to keep rolls hot during the meal instead of keeping the oven on or using an electric bun warmer.

7. Brown foods on medium high heat and then reduce to medium or low to finish cooking. This will reduce shrinkage and spattering and will consume less energy.

8. Use a timer with a loud bell to avoid overcooking and wasting energy.

9. Take advantage of the heat-sensing elements on gas and electric ranges to control the surface unit. It allows the unit to cut off the energy supply and coast occasionally while still cooking. Electric surface units can be shut off a short period (5 minutes or so) before the food is done. The food will continue to cook from stored energy.

10. Remember to turn off all units immediately after use. A warning light or buzzer is helpful as a reminder. Establish the habit of turning off the range before removing the utensil.

11. When cooking on top of the range, a vent fan can exhaust heated air directly to the outside and ease the burden on the home's cooling system. But, don't let it run needlessly.

The proper selection and use of cooking utensils can afford additional energy savings. The following considerations should be made:

(Utensils)

1. Pots and pans should fit the surface unit. The bottom should cover the heating element but not extend more than an inch over the edge. This will help minimize the amount of heat loss to the air. If the pot or pan is too large for the surface unit, it will heat unevenly and heat will reflect down to the range top around the unit and eventually craze it.

2. To insure minimal heat loss from the pot or pan, it should have a flat bottom, straight sides and a tightly fitting cover. Good utensils allow less heat to escape

and lower heat settings to be used. A pressure cooker can cut time and energy even more.

3. Ceramic, glass and stainless steel utensils retain heat better than other materials. When baking with these materials, the oven setting can be lowered 25 degrees.

4. Slightly lower temperatures can be selected when using teflon-lined utensils for frying or pan broiling on top of the range.

5. Use a tea kettle instead of a pan for heating or boiling water to avoid heat loss through steam.

6. Cover saucepans whenever possible. Food will cook faster and a lower temperature setting can be used. Be sure the lid fits tightly.

Care should be taken not to use energy for cooking appliances unnecessarily. Heating water and thawing foods are the most common causes for waste. The following tips can help avoid unnecessary energy use.

(Foods)

1. When heating or boiling large quanities of water, start with hot tap water where a major part of the heating has already been done more efficiently by the water heater.

2. Large amounts of water use more energy and lesson the nutritional value of foods. Use only enough water to make steam and avoid sticking when cooking vegetables. The water will heat faster and conserve energy. Remember to reduce the temperature to simmer as soon as the steaming point is reached and use a pan with a tight lid. Vegetables will retain more vitamins and minerals and taste better.

3. Frozen foods require more energy than completely thawed foods whether cooked in the oven, under the broiler or on top of the range. For example, a roast that has been defrosted requires 33 percent less cooking time than one that is still frozen. However, exercise caution to avoid bacterial growth.

4. Broiling meat is faster and more efficient than other methods.

Energy-conscious cooks schedule and plan for the most efficient use of their appliances. Cooking several items at the same time and choosing cooking times carefully can conserve energy. Following are suggested ways in which cooking might be better planned and scheduled.

(Methods)

1. Sometimes it is more practical to cook several dishes at once istead of reheating the oven several times during the day. Two or three dishes can be baked with little more energy than one. For example, if three dishes are to be cooked at similar temperatures (325o, 350o, and 375o) pick the average temperature (350o) and cook all three, making a small allowance in cooking time. The oven (which is more efficient than range top) can be used in this manner to prepare the entire meal.

2. Preparing multiple recipes for meals like spaghetti, sauce, soups and stews that take a long time to cook can save energy. Then refrigerate or freeze for future use.

3. By dividing a skillet with foil inserts, several dishes can be prepared simultaneously.

4. When baking or cooking foods with extended cooking times, try to avoid "peak hours" (8-11 a.m. and 4-8 p.m. are usually the peak hours).

Proper maintenance of cooking appliances is also important, not only to conserve energy but also for safety. Clean appliances work more efficiently, more safely, and more hygienically. Proper inspection of equipment will help ensure efficient operation. The following steps should be taken to maintain the efficiency of cooking appliances:

(Maintenance)

1. Keep heat reflection surfaces clean, especially the reflectors below the heating element on top of the range and the entire oven.

2. For the most efficient use of fuel, gas burners should have a steady blue flame. A yellow flame means it needs adjustment or cleaning.

3. Make sure the pilot on a gas range is properly adjusted. It may be using more fuel than necessary.

4. Have faulty switches, burners and thermostats fixed promptly and professionally. Check the oven thermostat every six months with a thermometer.

5. Make sure oven door seals are tight and not leaking heated air.

6. Air filters on exhaust fans must be cleaned periodically to work effectively and efficiently.

LESSON TITLE: Oven Use and Energy Consumption

LESSON OBJECTIVE:

The student will be able to demonstrate the energy consumption differences of conventional and microwave ovens.

BACKGROUND INFORMATION

Refer to previous Lesson C where more detailed information is available.

ACTIVITIES:

A microwave oven has the capability of saving energy as a result of the short cooking time needed for some foods. However, many foods may still be more efficently cooked in a conventional oven.

In the home economics laboratory, compare the energy required to cook the following food items: cake, tuna, casserole, frozen TV dinner, frozen broccoli, and baked potatoes. To determine the energy used to cook each item, calculate the energy used in kilowatt-hours. This can be done by first determining the wattage of the cooking unit (listed on the appliance):

_____ watts for microwave oven (usually around 1,450 watts)

_____ watts for conventional oven (usually around 12,200 watts)

Then determine the amount of time the unit operates to cook the food item. The operation time of the microwave oven will be easy to determine since it operates continuously and is usually equipped with a timer. The operation time of the conventional oven will be more difficult to determine since pre-heat time must be included and a conventional oven does not operate continously. A stopwatch will be needed to determine the operation time. You must time each interval that the oven is operating (most ovens are equipped with a light that indicates when the oven is operating) and add them to arrive at the total time of operation required to cook the food item.

Once the wattage and cooking times are determined, the energy use can be calculated.

For example: if a cup of squash requires 30 minutes to cook in a 12,000 watt oven, it requires 6 kilowatt-hours of energy:

$$\underline{12{,}000} \text{ watts} \times \underline{30} \text{ minutes} \times \frac{1^*}{\overline{60{,}000}} = \underline{6} \text{ kilowatt-hours}$$

*(The conversion factor is $\frac{1}{60{,}000}$ since there are 1000 watts to a kilowatt and 60 minutes to an hour.)

RESOURCES

Worksheets
Stop-Watch

DEVELOPED BY:

U.S. Department of Energy

Extra Material:

ASSIGNMENT

CAKE (Use the same recipe in each oven)

Conventional Oven

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

Microwave Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

TUNA CASSEROLE

Conventional Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

Microwave Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

FROZEN TV DINNER

Conventional Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

Microwave Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

FROZEN BROCCOLI

Conventional Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

Microwave Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

FOUR BAKED POTATOES

Conventional Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

Microwave Oven:

_____watts x _____minutes x $\frac{1}{60,000}$ = _____kilowatt-hour.

Tabulate Your Results

Food Item	Energy Use by Conventional Oven	Energy Used by Microwave Oven
CAKE	_____kilowatt-hour	_____kilowatt-hour
TUNA CASSEROLE	_____kilowatt-hour	_____kilowatt-hour
TV-DINNER	_____kilowatt-hour	_____kilowatt-hour
FROZEN BROCCOLI	_____kilowatt-hour	_____kilowatt-hour
BAKED POTATOES	_____kilowatt-hour	_____kilowatt-hour

Suggestions:

1. Remember that the quantities and types of foods cooked in the ovens must be the same to provide valid comparisons.

2. What would have been the effect on energy consumption if more than one food was cooked in the oven at once? Would this method of conserving energy be more effective for conventional or microwave ovens?

3. You may wish to choose different foods to test. If so, try to select a range of items from "dense" (such as meat) to "much less dense" (such as squash) to provide dramatic results.

Students prepare a variety of foods in lab using conventional and microwave ovens.

UNIT III

Resources

American Gas Association, A Consumer's Guide to Energy Conservation with Natural Gas, Arlington, Virginia; American Gas Association, (n.d.).

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Butel, Jane, Saving Electricity with Household Appliances, The Journal of Home Economics, November, 1975, pp. 20-22.

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Hirst, Eric, Energy Use for Food in the United States, ORNL-NSF-EP-57. Oak Ridge, Tennessee: Oak Ridge National Laboratory, 1973.

Katz, Deborah, and Mary T. Goodwin, Food: Where Nutrition, Politics and Culture Meet, Washington, D.C.: Center for Science in the Public Interest, 1976.

Office of Consumer Affairs, Consumer Register, Washington, D.C.: Government Printing Office.

U.S. Department of Commerce, Home Energy Saving Tips from NBS, Pueblo, Colorado: Public Documents Distribution Center (n.d.).

Vragel, Kurt, How to Save Energy in Your Home, Denver: Kurt Vragel Associates, Inc., 1975.

Knowing Your Home Appliance, from Porcelain Enamel Institute, 1900 "L" Street, N.W., Washington, D.C. 20036.

Americans for Energy Independence, 1629 "K" Street, N.W., 12th Floor, Washington, D.C. 20006.

Oven Meals for Any Hour, Harper-Wyman Company, 930 N. York Road, Hinsdale, Illinois 60521.

Utility Company pamphlets such as: Slow Cooker Recipes
Your Energy Budget Manager
Buyer's Guide to Portable Microwave Ovens
Food Drying Recipes

Facts About Food Freezing

The Electric Range

A Consumer's Guide to Portable Appliances

State Extension Agency: Drying Fruits and Vegetables
Small Appliance Pamphlets

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The Minnesota Trial Test Materials, Minnesota Department of Education, 625 Capital Square Building, St. Paul, Minnesota 55101 Mr. Tom Ryerson - Director of Program

Energy Management Strategies for Colorado Home Economics Teachers, developed by the Colorado State Board of Community Colleges and Occupational Education, by the Public Service Company of Colorado and by Energy and Man's Environment of Portland, Oregon

Energy Conservation: In the Home and On the Farm, developed by the Pennsylvania State University, College of Agriculture, Department of Agriculture Education, University Park, Pennsylvania in cooperation with Agricultural Education Section, Bureau of Vocational Education, Department of Education, Harrisburg, Pennsylvania and The Pennsylvania Farm Electrification Council - 1980.

Energy - Environmental, Mini-Unit Guide, a product of the NSTA (National Science Teachers Association) Materials Project, John M. Fowler, Director.

PLEASE TELL US WHAT YOU THINK ABOUT THE SENIOR HIGH SCHOOL ENERGY MATERIALS

Your position: (check)
_____teacher
_____dept. head
_____administrator
_____other

Your grade level:_____

Subject(s) taught:_____

If possible, please answer these questions after you have taught unit lesson(s) in your class and examined teacher's guide. If this is not possible, please answer based on your personal inspection of the unit materials.

1. What project materials are you evaluating? (Check all that apply)
   _____Unit I
   _____Unit II
   _____Unit III
   _____Unit IV
   _____Unit V
   _____Unit VI
   _____Unit VII
   _____Unit VIII
   _____Unit IX
   _____Teacher's Guide
2. What is the basis for this evaluation? (Check all that apply)
   _____(1) teaching 4 or more lessons
   _____(2) teaching 1 to 3 lessons
   _____(3) personal inspection
   _____(4) discussion with others who know materials
3. Have you shared these units with other educators? (Check one)
   _____(1) No
   _____(2) Yes, with 1-4 others
   _____(3) Yes, with 5-10 others
   _____(4) Yes, with more than 10

Circle the number from 1 (Definitely No) to 7 (Definitely Yes) which best reflects your answer.

		DEFINITELY NO			NEUTRAL			DEFINITELY YES
4.	Are these materials easy to understand and use?	1	2	3	4	5	6	7
5.	Do these materials fit with the curriculum of your district?	1	2	3	4	5	6	7
6.	Are you likely to make use of these materials in the future?	1	2	3	4	5	6	7
7.	Are these materials appropriate for the level of your students?	1	2	3	4	5	6	7
8.	Are these materials interesting to your students?	1	2	3	4	5	6	7
9.	Is the reading level appropriate?	1	2	3	4	5	6	7
10.	Do you think these materials will reduce energy consumption?	1	2	3	4	5	6	7

What did you like best?_____

What did you like least?_____

Suggestions/Comments (Use the back as needed):_____

RETURN TO: Energy Education Curriculum Project, Division of Curriculum, Department of Public Instruction, Room 229, State House, Indianapolis, IN 46204.